What Is Claimed Is:

1   1.   A method for detecting violations of type rules in a computer

2 program, comprising:

3   receiving the computer program;

4   locating a type casting operation within the computer program, wherein

5 the type casting operation involves a first pointer and a second pointer;

6   checking the type casting operation for a violation of a type rule; and

7   if a violation is detected, indicating the violation.

1   2.   The method of claim 1, wherein checking the type casting

2 operation involves determining if the first pointer is defined to be a structure

3 pointer and the second pointer is not defined to be a structure pointer, and if so,

4 indicating a violation if no char exception applies.

1   3.   The method of claim 2, wherein indicating the violation involves:

2   generating a warning to warn a programmer of a potential type violation if

3 the second pointer is a void or char pointer; and

4   generating an error to indicate a type violation to the programmer if the

5 second pointer is a pointer to a scalar.

1   4.   The method of claim 1, wherein if the first pointer is defined to

2 point to a first structure type and the second pointer is defined to point to a second

3 structure type, the method further comprises:

4   determining whether the first structure type and the second structure type

5 belong to the same alias group; and

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6   if the first structure type and the second structure type do not belong to the

7   same alias group, generating an error to indicate a type violation.

1   5.   The method of claim 4, wherein determining whether the first

2   structure type and the second structure type belong to the same alias group

3   involves:

4   keeping track of special program statements that link structure types into

5   alias groups;

6   determining that the first structure type and the second structure type

7   belong to the same alias group if the first structure type and the second structure

8   type are the same structure type, or if one or more special procedures link the first

9   structure type and the second structure type into the same alias group.

1   6.   The method of claim 5, further comprising determining that the

2   first structure type and the second structure type belong to the same alias group if

3   the first structure type and the second structure type have all the same basic types

4   in the same order.

1   7.   The method of claim 1, wherein the computer program is received

2   in source code form, and wherein the method further comprises parsing the

3   computer program into an intermediate form prior to locating the type casting

4   operation.

1   8.   The method of claim 1, further comprising:

2   receiving an identifier for a set of constraints on memory references that a

3   programmer has adhered to in writing the computer program; and

1   using the identifier to select a type casting rule from a set of type casting

2   rules, the selected type casting rule being associated with the set of constraints;

3   wherein each type casting rule in the set of type casting rules is associated

4   with a different set of constraints on memory references.

1   9.   The method of claim 1, wherein the method is performed by a

2   compiler.

1   10.   The method of claim 1, wherein the method is performed by an

2   error checking application, which is not part of a compiler.

1   11.   A computer-readable storage medium storing instructions that

2   when executed by a computer cause the computer to perform a method for

3   detecting violations of type rules in a computer program, the method comprising:

4   receiving the computer program;

5   locating a type casting operation within the computer program, wherein

6   the type casting operation involves a first pointer and a second pointer;

7   checking the type casting operation for a violation of a type rule; and

8   if a violation is detected, indicating the violation.

1   12.   The computer-readable storage medium of claim 11, wherein

2   checking the type casting operation involves determining if the first pointer is

3   defined to be a structure pointer and the second pointer is not defined to be a

4   structure pointer, and if so, indicating a violation if no char exception applies.

1   13.   The computer-readable storage medium of claim 12, wherein

2   indicating the violation involves:

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3   generating a warning to warn a programmer of a potential type violation if

4   the second pointer is a void or char pointer; and

5   generating an error to indicate a type violation to the programmer if the

6   second pointer is a pointer to a scalar.

1   14.   The computer-readable storage medium of claim 11, wherein if the

2   first pointer is defined to point to a first structure type and the second pointer is

3   defined to point to a second structure type, the method further comprises:

4   determining whether the first structure type and the second structure type

5   belong to the same alias group; and

6   if the first structure type and the second structure type do not belong to the

7   same alias group, generating an error to indicate a type violation.

1   15.   The computer-readable storage medium of claim 14, wherein

2   determining whether the first structure type and the second structure type belong

3   to the same alias group involves:

4   keeping track of special program statements that link structure types into

5   alias groups;

6   determining that the first structure type and the second structure type

7   belong to the same alias group if the first structure type and the second structure

8   type are the same structure type, or if one or more special procedures link the first

9   structure type and the second structure type into the same alias group.

1   16.   The computer-readable storage medium of claim 15, wherein the

2   method further comprises determining that the first structure type and the second

3   structure type belong to the same alias group if the first structure type and the

4   second structure type have all the same basic types in the same order.

1   17.   The computer-readable storage medium of claim 11, wherein the

2   computer program is received in source code form, and wherein the method

3   further comprises parsing the computer program into an intermediate form prior to

4   locating the type casting operation.

1   18.   The computer-readable storage medium of claim 11, wherein the

2   method further comprises:

3   receiving an identifier for a set of constraints on memory references that a

4   programmer has adhered to in writing the computer program; and

5   using the identifier to select a type casting rule from a set of type casting

6   rules, the selected type casting rule being associated with the set of constraints;

7   wherein each type casting rule in the set of type casting rules is associated

8   with a different set of constraints on memory references.

1   19.   The computer-readable storage medium of claim 11, wherein the

2   method is performed by a compiler.

1   20.   The computer-readable storage medium of claim 11, wherein the

2   method is performed by an error checking application, which is not part of a

3   compiler.

1   21.   An apparatus that detects violations of type rules in a computer

2   program, comprising:

3   a receiving mechanism that is configured to receive the computer program;

4   a locating mechanism that is configured to locate a type casting operation

5   within the computer program, wherein the type casting operation involves a first

6   pointer and a second pointer; and

7   a type rule checking mechanism that is configured check the type casting

8   operation for a violation of a type rule, and if a violation is detected, to indicate

9   the violation.

1   22.   The apparatus of claim 1, wherein the type rule checking

2   mechanism is configured to determine if the first pointer is defined to be a

3   structure pointer and the second pointer is not defined to be a structure pointer,

4   and if so, to indicate a violation if no char exception applies.

1   23.   The apparatus of claim 22, wherein the type rule checking

2   mechanism is configured to:

3   generate a warning to warn a programmer of a potential type violation if

4   the second pointer is a void or char pointer; and to

5   generate an error to indicate a type violation to the programmer if the

6   second pointer is a pointer to a scalar.

1   24.   The apparatus of claim 21, wherein if the first pointer is defined to

2   point to a first structure type and the second pointer is defined to point to a second

3   structure type, the type rule checking mechanism is configured to:

4   determine whether the first structure type and the second structure type

5   belong to the same alias group; and to

6   generate an error to indicate a type violation if the first structure type and

7   the second structure type do not belong to the same alias group.

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1   25.   The apparatus of claim 24, wherein in determining whether the

2 first structure type and the second structure type belong to the same alias group,

3 the type rule checking mechanism is configured:

4   keep track of special program statements that link structure types into alias

5 groups; and to

6   determine that the first structure type and the second structure type belong

7 to the same alias group if the first structure type and the second structure type are

8 the same structure type, or if one or more special procedures link the first structure

9 type and the second structure type into the same alias group.

1   26.   The apparatus of claim 25, wherein the type rule checking

2 mechanism is configured to determine that the first structure type and the second

3 structure type belong to the same alias group if the first structure type and the

4 second structure type have all the same basic types in the same order.

1   27.   The apparatus of claim 21,

2   wherein the receiving mechanism is configured to receive the computer

3 program in source code form; and

4   wherein the apparatus further comprises a parsing mechanism that is

5 configured to parse the computer program into an intermediate form prior to

6 locating the type casting operation.

1   28.   The apparatus of claim 21, wherein the receiving mechanism is

2 configured to receive an identifier for a set of constraints on memory references

3 that a programmer has adhered to in writing the computer program, and further

4 comprising:

1   a selection mechanism that is configured to use the identifier to select a

2   type casting rule from a set of type casting rules, the selected type casting rule

3   being associated with the set of constraints;

4   wherein each type casting rule in the set of type casting rules is associated

5   with a different set of constraints on memory references.

1   29.   The apparatus of claim 21, further comprising a compiler that

2   contains the receiving mechanism, the locating mechanism and the type rule

3   checking mechanism.

1   30.   The apparatus of claim 21, further comprising an error checking

2   application, which is not part of a compiler;

3   wherein the error checking application contains the receiving mechanism,

4   the locating mechanism and the type rule checking mechanism.